966,760

PATENT SPECIFICATION

DRAWINGS ATTACHED

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Date of Application and filing Complete Specification Dec. 21, 1960.

No. 43891/60.

Application made in Germany (No. L35018 VIIIb/21c) on Dec. 28, 1959.

Complete Specification Published Aug. 12, 1964.

Index at acceptance:—H2 H5B; H1 S(5, 6A4, 6C7, 8)

International Classification: —H 02 h (H 01 c)

COMPLETE SPECIFICATION

An Electrical Surge Diverter

We, LICENTIA PATENT-VERWALTUNGS-G.M.B.H., of, 1 Theodor-Stern-Kai, Frankfurt am Main, Western Germany, a German Body Corporate, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electric surge diverters of the kind comprising series connected resistors in the forms of discs stacked together to form a column and discharge gaps arranged in the connection of at least some of the resistor discs.

Diverters of this kind have a comparatively large height particularly when constructed for high voltages. They are, as a rule, much higher than other high-voltage equipment, such as supporting insulators or insulating bushings, designed for the same rated voltage and therefore require excessive space.

With a view of reducing the height of surge diverters of the kind mentioned, discs of a larger diameter but of the same axial thickness have been used and these discs have been so constructed that each disc forms two separate resistors which were connected in series. In this manner a so-called compound resistor disc was obtained, that is to say a disc containing two series connected partial resistors and having the height of one resistor disc of the former construction, so that the height of the resistor column could be reduced substantially to half its former magnitude.

The compound resistor disc was made in such a manner that a comparatively thin transverse layer of insulating material was incorporated in the disc so as to divide the resistor material disc into two halves. Resistor discs of this kind are usually made by sintering. The resistor forming material usually consists of granulated silicon carbide and the insulating material consists of granulated corundum; these granulated materials are mixed with a suitable binder and are then sintered under heavy pressure in a mould. Considerable care is then necessary during the introduction of the material into the mould and during the application of the pressure in order to prevent the resistor material from bridging the insulating layer wholly or even partially because such bridging could lead to preliminary discharges or short-circuits as a result of which the discs would become useless. Furthermore, electric boundary fields appear at the outer edge of the discs at the transition points between the insulating layer and the component resistor discs which fields could also cause unwanted discharges.

It is the object of the invention to overcome the mentioned difficulties, that is to say to facilitate the manufacture of the compound resistor discs and to avoid to a large extent the occurrence of unwanted discharges.

The invention consists in an electric surge diverter comprising series connected resistors in the form of discs stacked one above the other to form a column and discharge gaps arranged in the connection of at least some of the resistor discs, wherein each resistor disc which is formed throughout of the same material, has a central axial bore and is provided at both sides with a layer of conducting material with the exception of a transverse zone at both sides of an axial plane so that each two oppositely disposed conducting layer sections define a resistor section, wherein the resistor sections of a disc are conductively connected in series, and wherein the discharge gap, when provided in the connection between two adjacent resistor discs, is arranged within the central bore of the disc.

In order that the invention may be clearly understood, it will now be described in more detail with reference to the accompanying drawing in which

Figure 1 illustrates a plan view of an ex-

[Price 4s. 6d.]

ample of a compound resistor disc according to the invention, whilst

Figure 2 shows a cross section of this disc and also indicates part of the adjacent discs of the electric surge diverter formed by these discs.

As shown, the disc 1, which consists throughout of the same resistor material, has a large axial central bore 5 and is provided at both sides with a layer of conductive material with the exception of a transverse zone 22 at both sides of an axial plane so that two pairs of oppositely disposed crescent-shaped layers 2, 2^1 and 3, 3^1 are formed. Each of these two pairs of conductive layers defines a separate resistor section within the homogenous resistor disc because the resistance between each two oppositely disposed conducting layers 2, 2^1 or 3, 3^1 is smaller than the resistance provided by the resistor material between the two resistor sections.

The two resistor sections are connected in series by means of two parallel connecting strips 4 which are arranged in the centre bore 5. A discharge gap, consisting of an electrode 6 with connecting strip 7 and an electrode 8 with connecting strip 9, is accommodated in the centre bore 5 secured to a supporting ring 10. As can be seen from Figure 2, the compound resistor disc 1 is insulated by means of an insulating disc 11 from the following upper compound resistor disc 12, which is constructed in precisely the same manner as the disc 1 and generally also comprises an arc gap in its bore. The superimposed discs are connected in series by means of the connecting strips 7 and 9 which strips incorporate the electrodes 6 and 8 of the discharge gap. The connecting strip 7, as shown in Figure 2, connects the upper contact coating 2 of the right-hand section of the resistor 1 to the discharge gap electrode 6, and the connecting strip of the lower contact coating 13 connects the compound resistor disc 12 to the electrode 8 of the discharge gap of disc 1. Correspondingly, the connecting strip 14 forms a connection to a discharge gap in the compound disc situated below the disc 1, the last mentioned two resistor discs being separated by an insulating disc 15. The current path when the discharge gaps become conducting, is indicated by the arrows 16, 17, 18, 19, 20 and 21 in Figure 2.

As can be seen from Figures 1 and 2, the adjacent resistor sections of a compound resistor disc are formed as a result of the fact that disc sections are formed in a homogeneous disc having a central bore by means of superimposed contact surface sections applied by a metal spraying process, which sections are separated from one another by means of a continuous non-conducting zone 22. Thus, before an arc is produced in the discharge gaps, that is to say so long as the current flowing through the diverter is very low, of the order of magnitude of one mA or less, the compound resistor disc represents substantially a body of uniform potential, that is say an equipotential surface. This phenomenon results from the fact that the said very low currents cause practically no voltage drop in the compound resistor disc; so long as no arcs are formed at the discharge gaps, the voltage appearing at the diverter drops across the discharge gaps.

In the operating condition, however, which is characterised by discharges across the discharge gaps of the diverter and as a result of the construction of the compound resistor discs described, the effect is obtained that each disc forms two electrically independent resistors sections connected in series. In view of the high current flowing in succession through the sections of a resistor disc, any "leakage currents" flowing through the disc in the region of the contact-free zones 22 are negligibly small.

In the preceding description attention has been drawn to the fact that surge diverters for very high rated voltages are built up from an appropriately large number of resistor discs and quenching arc gaps. This means that such a diverter will be composed of a correspondingly large number of compound discs. In order to obtain a uniform distribution of the voltage, particularly alternating voltage, appearing at the diverter, additional means for a resistance control of the discharge gaps may be provided. In the present case, these control means are then preferably likewise accommodated inside the central bores 5; advantageously, each of the supporting members 10 may be given such a resistance that it may also serve as a control resistor for equalising the voltage drops across the discharge gaps formed by the electrodes 6 and 8.

A particularly simple construction of a surge diverter for very high rated voltage according to the invention is obtained if the discharge gap elements with their contact strips and any control resistors bridging the discharge gaps are combined with the insulating discs, for instance 11 and 15, to form a structural unit. In the assembly of such diverters it is then only necessary to stack up compound resistor discs and the intermediate elements alternately one above the other.

Although in general in a surge diverter built up according to the invention, each compound resistor disc is equipped with a discharge gap in its bore, such a division of the discharge gap is not absolutely essential and a construction is conceivable in which, for example, every other compound resistor disc receives an arc gap in its bore. In such cases, insulating discs with discharge gaps and insulating discs without discharge gaps provided with series-connecting strips may be used alternately between the individual resistor discs. If the disc 1 shown in the drawing were a disc

without discharge gap, the mentioned series-connecting strip would be a continuous strip replacing the strips 7 and 9 shown in Figure 2.

WHAT WE CLAIM IS:—

1. An electric surge diverter comprising series connected resistors in the form of discs stacked one above the other to form a column and discharge gaps arranged in the connection of at least some of the resistor discs, wherein each resistor disc which is formed throughout of the same material, has a central axial bore and is provided at both sides with a layer of conducting material with the exception of a transverse zone at both sides of an axial plane so that each two oppositely disposed conducting layer sections define a resistor section, wherein the resistor sections of a disc are conductively connected in series, and wherein the discharge gap, when provided in the connection between two adjacent resistor discs, is arranged within the central bore of the disc.

2. A diverter as claimed in claim 1, wherein the conductive series connection between the two resistor sections of a resistor disc is effected by conducting strips arranged within the said central bore of the resistor disc.

3. A diverter as claimed in claim 1 or 2, also comprising control resistors for the control of the voltage drop across the discharge gaps, which control resistors are arranged within the said central bore of the resistor disc that is associated with a discharge gap.

4. A diverter as claimed in any one of the preceding claims, wherein an insulating disc is arranged between each pair of adjacent resistor discs, and wherein the members of a discharge gap of one of the said resistor discs are structurally combined with the said insulating disc.

5. An electric surge diverter having resistor discs substantially as described with reference to and as illustrated in the accompanying drawing.

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Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1964.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

966760 COMPLETE SPECIFICATION

1 SHEET This drawing is a reproduction of the Original on a reduced scale

Fig.1

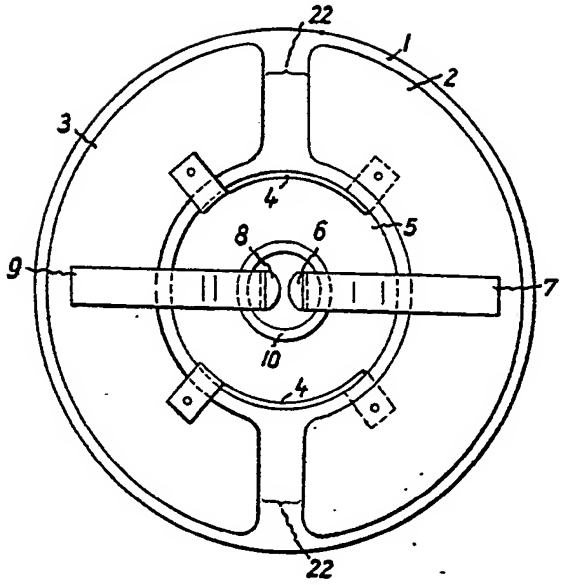

Fig.2